(1) The steady gradient of climb may not be less than 1.2 percent for two-engine airplanes, 1.5 percent for three-engine airplanes, and 1.7 percent for four-engine airplanes, at V_{FTO} with—

(i) The critical engine inoperative and the remaining engines at the available maximum continuous power or thrust; and

(ii) The weight equal to the weight existing at the end of the takeoff path, determined under § 25.111.

(2) The requirements of paragraph (c)(1) of this section must be met:

(i) In non-icing conditions; and

(ii) In icing conditions with the final takeoff ice accretion defined in appendix C, if in the configuration of § 25.121(b) with the takeoff ice accretion:

(A) The stall speed at maximum takeoff weight exceeds that in non-icing conditions by more than the greater of 3 knots CAS or 3 percent of V_{SR}; or

(B) The degradation of the gradient of climb determined in accordance with § 25.121(b) is greater than one-half of the applicable actual-to-net takeoff flight path gradient reduction defined in § 25.115(b).

(d) *Approach.* In a configuration corresponding to the normal all-engines-operating procedure in which V_{SR} for this configuration does not exceed 110 percent of the V_{SR} for the related all-engines-operating landing configuration:

(1) The steady gradient of climb may not be less than 2.1 percent for two-engine airplanes, 2.4 percent for three-engine airplanes, and 2.7 percent for four-engine airplanes, with—

(i) The critical engine inoperative, the remaining engines at the go-around power or thrust setting;

(ii) The maximum landing weight;

(iii) A climb speed established in connection with normal landing procedures, but not exceeding 1.4 V_{SR}; and

(iv) Landing gear retracted.

(2) The requirements of paragraph (d)(1) of this section must be met:

(i) In non-icing conditions; and

(ii) In icing conditions with the approach ice accretion defined in appendix C. The climb speed selected for non-icing conditions may be used if the climb speed for icing conditions, computed in accordance with paragraph (d)(1)(iii) of this section, does not exceed that for non-icing conditions by more than the greater of 3 knots CAS or 3 percent.

[Doc. No. 5066, 29 FR 18291, Dec. 24, 1964, as amended by Amdt. 25–84, 60 FR 30749, June 9, 1995; Amdt. 25–108, 67 FR 70826, Nov. 26, 2002; Amdt. 25–121, 72 FR 44666; Aug. 8, 2007]

§ 25.123 En route flight paths.

(a) For the en route configuration, the flight paths prescribed in paragraph (b) and (c) of this section must be determined at each weight, altitude, and ambient temperature, within the operating limits established for the airplane. The variation of weight along the flight path, accounting for the progressive consumption of fuel and oil by the operating engines, may be included in the computation. The flight paths must be determined at a speed not less than V_{FTO}, with—

(1) The most unfavorable center of gravity;

(2) The critical engines inoperative;

(3) The remaining engines at the available maximum continuous power or thrust; and

(4) The means for controlling the engine-cooling air supply in the position that provides adequate cooling in the hot-day condition.

(b) The one-engine-inoperative net flight path data must represent the actual climb performance diminished by a gradient of climb of 1.1 percent for two-engine airplanes, 1.4 percent for three-engine airplanes, and 1.6 percent for four-engine airplanes—

(1) In non-icing conditions; and

(2) In icing conditions with the en route ice accretion defined in appendix C, if:

(i) A speed of 1.18 ''V_{SR0} with the en route ice accretion exceeds the en route speed selected for non-icing conditions by more than the greater of 3 knots CAS or 3 percent of V_{SR}; or

(ii) The degradation of the gradient of climb is greater than one-half of the applicable actual-to-net flight path reduction defined in paragraph (b) of this section.

(c) For three- or four-engine airplanes, the two-engine-inoperative net flight path data must represent the actual climb performance diminished by a gradient of climb of 0.3 percent for three-engine airplanes and 0.5 percent for four-engine airplanes.

[Docket No. 5066, 29 FR 18291, Dec. 24, 1964, as amended by Amdt. 25–121, 72 FR 44666; Aug. 8, 2007]

§ 25.125 Landing.

(a) The horizontal distance necessary to land and to come to a complete stop (or to a speed of approximately 3 knots for water landings) from a point 50 feet above the landing surface must be determined (for standard temperatures, at each weight, altitude, and wind within the operational limits established by the applicant for the airplane):

(1) In non-icing conditions; and

(2) In icing conditions with the landing ice accretion defined in appendix C if V_{REF} for icing conditions exceeds V_{REF} for non-icing conditions by more than 5 knots CAS at the maximum landing weight.

(b) In determining the distance in paragraph (a) of this section:

(1) The airplane must be in the landing configuration.

(2) A stabilized approach, with a calibrated airspeed of not less than V_{REF}, must be maintained down to the 50-foot height.

(i) In non-icing conditions, V_{REF} may not be less than:

(A) 1.23 $V_{SR}0$;

(B) V_{MCL} established under §25.149(f); and

(C) A speed that provides the maneuvering capability specified in §25.143(h).

(ii) In icing conditions, V_{REF} may not be less than:

(A) The speed determined in paragraph (b)(2)(i) of this section;

(B) 1.23 V_{SR0} with the landing ice accretion defined in appendix C if that speed exceeds V_{REF} for non-icing conditions by more than 5 knots CAS; and

(C) A speed that provides the maneuvering capability specified in §25.143(h) with the landing ice accretion defined in appendix C.

(3) Changes in configuration, power or thrust, and speed, must be made in accordance with the established procedures for service operation.

(4) The landing must be made without excessive vertical acceleration, tendency to bounce, nose over, ground loop, porpoise, or water loop.

(5) The landings may not require exceptional piloting skill or alertness.

(c) For landplanes and amphibians, the landing distance on land must be determined on a level, smooth, dry, hard-surfaced runway. In addition—

(1) The pressures on the wheel braking systems may not exceed those specified by the brake manufacturer;

(2) The brakes may not be used so as to cause excessive wear of brakes or tires; and

(3) Means other than wheel brakes may be used if that means—

(i) Is safe and reliable;

(ii) Is used so that consistent results can be expected in service; and

(iii) Is such that exceptional skill is not required to control the airplane.

(d) For seaplanes and amphibians, the landing distance on water must be determined on smooth water.

(e) For skiplanes, the landing distance on snow must be determined on smooth, dry, snow.

(f) The landing distance data must include correction factors for not more than 50 percent of the nominal wind components along the landing path opposite to the direction of landing, and not less than 150 percent of the nominal wind components along the landing path in the direction of landing.

(g) If any device is used that depends on the operation of any engine, and if the landing distance would be noticeably increased when a landing is made with that engine inoperative, the landing distance must be determined with that engine inoperative unless the use of compensating means will result in a landing distance not more than that with each engine operating.

[Amdt. 25–121, 72 FR 44666; Aug. 8, 2007; 72 FR 50467, Aug. 31, 2007]

CONTROLLABILITY AND MANEUVERABILITY

§ 25.143 General.

(a) The airplane must be safely controllable and maneuverable during—

(1) Takeoff;

(2) Climb;

(3) Level flight;

(4) Descent; and

(5) Landing.